B-955

Fertilizing Texas Pastures

TEXAS AGRICULTURAL EXTENSION SERVICE
J. E. HUTCHISON, DIRECTOR, COLLEGE STATION, TEXAS

[Blank Page in Original Bulletin]

Fertilizing Texas Pastures

E. M. TREW, Extension Pasture Specialist
W. F. BENNETT, Extension Soil Chemist
The Texas A. & M. College System

FERTILIZER IS NECESSARY for the establishment and maintenance of cultivated pastures in many Texas areas. Where fertilizer is not required for establishment, it is needed to maintain production. It insures adequate protein and mineral content of plants, resulting in better livestock health and performance. Proper fertilization allows plants to make efficient use of water, and it is a definite aid in weed control when other good management practices are followed.

FERTILIZERS

PLANT NUTRIENTS

The four major plant nutrients needed by pastures, nitrogen, phosphorus, potassium and calcium, are necessary for proper plant growth and development. A shortage of one results in poor plant response to the others; an excess of one may result in poor utilization of the others. Each nutrient performs definite functions in the life processes of plants. For a discussion of the various plant nutrients in plant growth and development, see Extension Service B-167, Fertilizers and Their Use.

Fertilizer rates discussed in this publication are expressed as pounds-per-acre of the actual plant nutrients. A 30-60-60 per-acre rate would mean 30 pounds of N, 60 pounds of P_2O_5 and 60 pounds of K_2O. This amount of plant nutrients could be obtained from 300 pounds of 10-20-20 fertilizer. Similarly, a 90-60-60 rate could be obtained by applying 500 pounds of 3-12-12 plus approximately 225 pounds of ammonium nitrate; or, it might be obtained from 300 pounds of 10-20-20 plus 300 pounds of ammonium sulfate.

Nitrogen is expressed in terms of actual nitrogen (N). Most Texas soils are deficient in nitrogen. Its most important function is to stimulate growth, and it is the key plant nutrient in grass production.

Phosphorus is expressed as P_2O_5 and is commonly referred to as phosphate. It is the key plant nutrient in legume production. It is necessary for maturity, root development and seed formation, along with other functions. More than half of the Texas soils need additional phosphorus for satisfactory production of cultivated pasture plants.

Potassium generally is referred to as potash (K_2O). Along with other roles in plant nutrition, potassium increases stalk strength and aids in disease resistance. Most soils in the western half of Texas and many of the heavy soils in the eastern half contain adequate potassium.

Calcium (CaO) is the principal plant nutrient found in limestone. Calcium promotes proper root and stem development and stimulates general plant health as a plant nutrient. Limestone is applied to correct soil acidity. Some pasture plants will not grow in strongly acid soils, and others do not grow as well on acid soils as on soils that contain moderate to large amounts of lime. For example, white-clover grows best when the soil acidity (expressed as pH) is 6.0 to 7.0; Bermudagrass and Sudangrass do best where the pH is 6.0 to 7.5; oats have a soil reaction preference of 6.0 to 7.0. Few pasture plants produce well where the pH is below 6.0, and many will not grow where it is as low as 5.0. East Texas Timberland soils, those in the adjoining post oak area and several soils in the Coast Prairie are normally deficient in lime.

MANURE

Barnyard or poultry manure may be used to supply part of the needed plant nutrients. These are valuable materials and should be utilized. A ton of average manure from a dairy barn contains about the same amount of nutrients as 100 pounds of fertilizer grading 8-4-8. Barnyard manure generally is low in phosphorus and should be supplemented with phosphorus from superphosphate or some other source to avoid phosphorus deficiency and nutrient imbalance. The quicker this manure is spread, the more value it has as a fertilizer. Exposure to sun and rain results in rapid loss of some nutrients.

A ton of poultry manure usually contains about the same amount of plant nutrients as 100 pounds of fertilizer grading 20-16-8. It should be supplemented with potassium as needed to insure adequate amounts for good plant growth. It is relatively high in nitrogen and phosphorus and is excellent for use on pastures.

A considerable amount of the nutrients taken up in pasture plants is returned to the

soil in the droppings and urine of grazing animals that spend most of their time in the pasture. Pasture plants growing in manure piles and in the halos, or dark-green rings, around them usually are refused by grazing animals. The manure piles should be scattered as often as needed by harrowing or dragging to get better utilization of the pasture growth produced. The larger the number of animals a pasture is supporting, the more frequently the droppings will need scattering. Recent research in a Southeastern state showed manure piles and the halos were responsible for a loss of 70 percent of the grazing in a high-producing pasture by the time the pasture has been grazed from April to September.

REASONS FOR FERTILIZING

ESTABLISHMENT

To try to establish stands of desirable pasture plants on low-fertility soils without adequate fertilizer and lime is impractical. If such soils would support a good stand and growth of desirable pasture plants, those or similar plants would be present and thriving without the necessity for establishment. A good example is on sandy soils in areas where Common Bermuda grows well. Common Bermuda comes in naturally on these soils when their fertility level is built up to the point that they will support the grass. Attempts to grow Bermuda or other desirable pasture plants on these soils fail until adequate plant nutrients are made available. Soils too poor to grow desirable pasture plants produce mostly low-quality grasses and weeds. Attempts to establish desirable pasture plants on such soils without proper use of fertilizer and lime result in thin, weak stands that are taken over by weeds and weedy grasses.

Some pasture plants have higher nitrogen, phosphorus and potassium requirements than others. Requirements are higher for Sudangrass than for pearl millet; they are greater for crimson clover than for vetch; blue panic requires more fertility than lovegrass; Coastal Bermuda has higher requirements than K. R. bluestem; whiteclover requires more plant nutrients than hopclover. Plants also differ in their calcium requirements. Thrifty stands of crimson clover cannot be established unless soils contain adequate amounts of calcium and soil pH is at a proper level.

PLANT GROWTH

Many stands of pasture plants die or become weak, weedy and unprofitable after establishment because they are not fertilized properly to maintain production. Blue panic and buffelgrass decline in production when they are not given adequate plant nutrients for good growth. Coastal, Midland and Common Bermuda are yellowish-green and short when they do not receive enough fertilizer for good growth. Whiteclover and other similar fertility-sensitive plants disappear when the plant nutrient level in the soil drops below their minimum needs. Maintaining satisfactory growth of established pasture plants requires close attention to plant nutrient balance and level.

Unfertilized plots of Bermuda, Dallis and carpet grasses with lespedeza on Nacogdoches clay loam at the Nacogdoches Station produced an average of 6,550 pounds of hay per acre per year during four seasons, 1951-54. Plots receiving 30-60-60 annually produced average annual yields of 9,540 pounds for a net return of $9.39 per acre. Areas receiving 90-60-0 per year produced an average of 14,620 pounds with a net return of $61.05.

Dallisgrass and whiteclover grown on Lake Charles Clay at the Angleton Experiment Station during 1952 and 1953 produced 4,05 pounds of hay per year with no fertilizer and 6,550 pounds when fertilized at the rate of 60-60-0 per year.

Common Bermudagrass grown at the Blackland Station, Temple, produced annual yields of 6,285 pounds of hay with no fertilizer 9,625 with 45 pounds of N annually and 9,8 pounds when 90 pounds of N per acre per year were applied. Greater yield increases were obtained with Coastal Bermuda using the same fertilizer treatments. The Coastal yield was 10,215 with no fertilizer, 12,530 with 45 pounds of N and 16,215 pounds when 90 pounds of N were applied each year. Applying phosphorus alone gave no forage increase in this test, but it did result in increased phosphorus content of the forage.

During 1955 and 1956, Coastal Bermuda was grown on upland sandy loam at the Pa

Nutrients taken up by pasture plants are returned to the soil in droppings and urine of grazing animals.

ture Investigations Laboratory, Mt. Pleasant, on plots receiving uniform adequate amounts of phosphorus and potassium. Plots receiving no nitrogen produced 1,580 pounds of hay per acre per year, 30 pounds of N per acre per year produced 2,470 pounds, 60 pounds of N produced 3.950 pounds while plots receiving 120 pounds of N per acre per year produced an annual average hay yield of 6,120 pounds.

Irrigated Coastal Bermuda, grown on Harlingen clay by the Lower Rio Grande Valley Station, produced 6 tons of hay per acre when no nitrogen was applied and 10.8 tons when 80 pounds of N were used. Almost 3 tons more hay was produced with about $10 worth of nitrogen per acre.

Oats receiving no fertilizer produced 3,820 pounds of forage, while oats fertilized at the rate of 60-30-0 produced 5,175 pounds of forage. The oats were grown on Houston black clay at the Blackland Station over the three seasons, 1953-55.

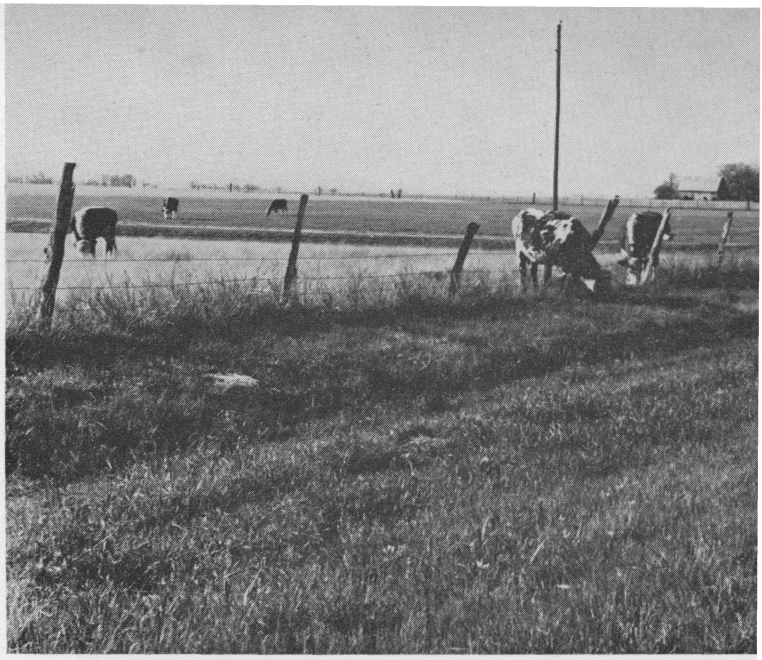
From 1951 to 1954 at Nacogdoches on land that had been limed, vetch produced 3,170 pounds of hay with no fertilizer, while crimson clover produced 2,830 pounds. On plots fertilized at the rate of 0-42-21, vetch produced 4,060 pounds and crimson 3,640 pounds of hay.

FORAGE QUALITY

Available plant nutrients in a soil influence the protein and mineral content of the forage. In general, nitrogen will increase the protein content of forage plants. The phosphorus, potassium and calcium contents in a plant usually are higher when the soil is well supplied with these nutrients. The most common deficiency in grass is phosphorus, and calcium is also frequently deficient.

Irrigated Coastal Bermuda, grown at College Station by the Texas Agricultural Experiment Station, contained 8.0 percent protein when no nitrogen was applied. Applying 100 pounds of N per acre raised the protein content to 9.1, 400 pounds raised it to 11.7 and 1,200 pounds increased the protein level further to 13.7 percent. The grass was grown from 1954 to 1957 on a Lufkin fine sandy loam soil that received adequate phosphorus, potassium and calcium.

Clippings collected in May from Common Bermuda grown on unfertilized Houston black clay at the Blackland Station contained 14.5 percent protein. Clippings from plots receiving 45 pounds of N per acre contained 14.9 percent and 90 pounds of N per acre increased the protein content to 15.5 percent. The samples from unfertilized plots contained 0.40 percent P_2O_5, while grass receiving 90 pounds of P_2O_5 per acre contained 0.45 percent P_2O_5. The protein and P_2O_5 content of Coastal Bermuda in the same test increased in a similar manner with fertilization.



Cattle prefer high-quality forage as evidenced by fertilized compared with unfertilized pastures.

EFFICIENT USE OF WATER

Plants well-supplied with plant nutrients use available moisture more efficiently than those undersupplied. Properly fertilized plants or those grown on fertile soil do not wilt as quickly during drouth as plants grown on nutrient-deficient soils.

In the previously mentioned Coastal Bermuda test at College Station, the grass without nitrogen used 17.6 acre inches of water for each ton of hay produced. Adding 100 pounds of N per acre reduced the water used to 10.7 acre inches per ton of hay. When 400 pounds of N were applied, the water used per ton of hay dropped to 5.5 acre inches, and with 800 pounds of N, only 3.9 acre inches were used per ton of hay produced.

WEED CONTROL

Proper fertilization is a definite aid in pasture weed control. Adequate plant nutrients encourage a dense, vigorous growth of desirable plants which suppress and crowd out weeds. Weak, thin stands of pasture plants are invaded by weeds and weedy grasses, most of which have lower fertility requirements than the desirable plants. For additional information on weed control, see B-892, "Weed Control in Texas Pastures."

FERTILIZER RATES FOR PASTURES

An 8-ton-per-acre crop of Coastal Bermuda hay removes from the soil an estimated 300 pounds of N, 70 pounds of P_2O_5, 270 pounds

of K_2O and 59 pounds of CaO. Five tons of sweetclover hay remove an estimated 185 pounds of N, 45 pounds of P_2O_5 and 165 pounds of K_2O. These quantities of plant nutrients would not necessarily all have to be added in the form of fertilizer, for some would become available through natural processes of decomposition of organic matter and minerals in the soil. However, some nutrients would have to be supplied as fertilizer.

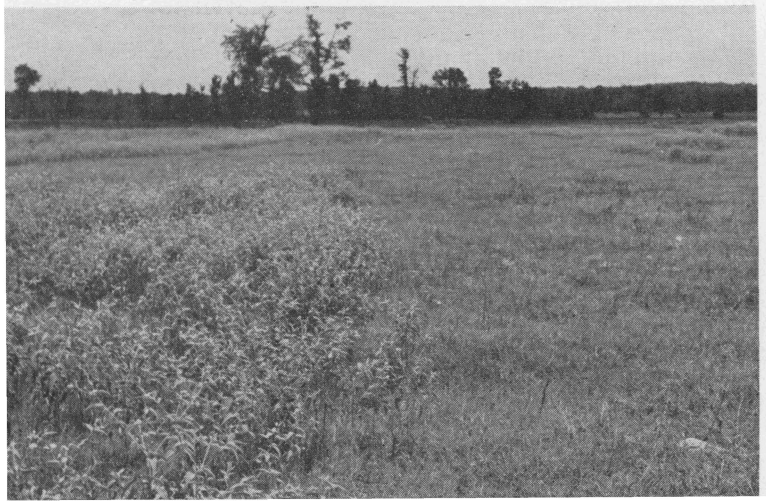
Several factors influence the amount of fertilizer that should be applied to pastures. Some of the more important are the soil, pasture plants grown, available moisture expected for growth, grazing or utilization management to be followed and the expected per unit price of the livestock products to be sold.

Some soils naturally are more fertile than others, requiring less fertilizer for the same amount of forage produced. For example, a Lake Charles clay would require less fertilizer to produce a satisfactory growth of Dallisgrass and whiteclover than would an Edna clay loam.

Plants differ in their ability to make efficient use of plant nutrients. Coastal Bermuda can make efficient use of much higher rates of fertilizer than Common Bermuda. Dallisgrass apparently cannot make good use of very large amounts of plant nutrients. Hopclover and lespedeza have limited ability to use plant nutrients.

The more moisture that is available for plant growth, the more fertilizer that can be used profitably. Plant nutrients must be in solution before plants can make use of them. Under natural rainfall conditions, moderate to large amounts of fertilizer would be more profitable in the 40-inch rainfall area than in areas receiving 25 inches. Proper fertilization is essential for profitable irrigated pasture production.

Chemical weed control and proper fertilization encourage dense, vigorous growth of desirable plants.



Continuous overgrazing limits the good r sponse that would be obtained otherwise fro proper fertilization. Keeping plants graze too short restricts their root systems and pr vents their making efficient use of availab plant nutrients. On the other hand, unde grazing or underutilization results in waste forage and loss of plant nutrients. Pastur growth not needed for grazing should be uti ized for hay or silage when the growth an need make this practical.

Poor-quality livestock or poor livestoc management, which results in low animal pr duction or poor performance, limits profit th proper fertilization might make possible.

General fertilizer recommendations for th various soil resource areas of Texas are i Extension Service Leaflets, L-220 throug L-228, available from county agricultur agents. *A soil test is the best way to dete mine the grade and amount of fertilizer neede* Recommendations based on soil tests are muc more accurate than general recommendation *A dollar for a soil test is the best fertiliz dollar you can spend.* County agricultur agents have instructions on taking soil sample information sheets, and containers for sub mitting soil samples for testing.

FERTILIZING FOR ESTABLISHMENT

Fertilizer for establishment of grasses a legumes should be applied in a band 2 to inches below and slightly to the side of th drill where the seed are to be placed. Re search shows that banding for establishme results in better stands and more efficie use of fertilizer. Broadcasting fertilizer en courages weed growth. It also results i greater phosphate reversion, or tie-up, due t iron or calcium.

In a test at the Blackland Station, supe phosphate applied in a band 2 to 3 inch below the seed was compared with broadcasti the fertilizer for establishment of Madr sweetclover. Four-fifths of the phosphor content of the plants seeded above the band superphosphate came from the fertilizer ap plied, while only one-fourth of the total pho phorus content of the plants on the broadca fertilizer plots came from the fertilizer a plied. Sweetclover from plots where the fe tilizer was banded produced 4,570 pounds hay per acre, compared with 3,680 pounds fr plots where the superphosphate was broadca

On land where a particularly heavy sta of weeds or weedy grasses is expected, fe tilizer may be applied in a band as a sid dressing after the pasture plants have beg growth. Or, the phosphate and potash m

be banded ahead of or at the time of planting and the nitrogen applied later as a side-dressing.

An application of 15 to 30 pounds of N per acre for establishment of legumes in most areas will insure rapid, early growth. Although legumes take some nitrogen from the air, they do not fix any nitrogen until they have established a root system.

FERTILIZING FOR MAINTENANCE

Pastures of Bermuda, Dallis, buffelgrass, blue panicgrass or other warm-season perennial grasses should receive nitrogen, phosphorus and potassium as needed in the spring about the time they begin growth. A topdressing or sidedressing of 30 to 50 pounds of N per acre, if sufficient moisture is available, should be applied each time the plants are grazed down or cut. If a legume, such as whiteclover, vetch or crimson clover, is grown with the grass, the phosphorus and potassium may be applied in the fall before the legume starts growth, to stimulate growth of the legume. Then, nitrogen should be applied to the grass in the spring after the legume has seeded. Legumes grown with grasses will supply some nitrogen for grass growth, but the amount actually supplied has generally been greatly exaggerated. The amount of nitrogen supplied for perennial grasses by legumes should be figured at no more than 15 to 30 pounds per acre, even for a good stand and growth of the legume, under Texas conditions.

Fertilizer for grasses, such as buffel and blue panic maintained in rows, should be applied in a band slightly below the soil surface midway between the rows. Applications of phosphorus and potassium for broadcast stands of grass, such as Bermuda and Dallis, may be applied broadcast to the soil surface when a good sod is present and when the soil is sandy or is a neutral to slightly acid soil in the higher rainfall area. Some of the fertilizer applied broadcast to a thin sod may be washed down the slope before it penetrates the soil. Some phosphorus in fertilizer broadcast on the soil surface may be made unavailable by the calcium in alkaline soils. In situations where topdressing is undesirable, the fertilizer should be drilled into the sod when possible.

Good yields of grass can be maintained through proper use of fertilizer and other good management practices.

Temporary pastures, such as oats and Sudangrass, should receive some nitrogen and all the phosphorus and potassium prior to or at the time of planting. Then they should be topdressed or sidedressed with 30 to 50 pounds of N per acre each time they are grazed down or cut, if moisture is available for growth and more grazing is needed.

Limestone can be applied to established pastures anytime during the year. However, it usually is applied from early fall to late spring.

METHODS OF APPLICATION

Most farm machinery companies make fertilizer distributers that are satisfactory for use on pastures. The most common is the box-type broadcast distributor. Grassland drills place fertilizer beneath the soil surface with minimum disturbance of the sod and plant large or small seed or both in the same operation. These two types are used most widely on pasture sods. Row crop-type fertilizer distributors are used most commonly for fertilization of grasses grown in rows.

Fertilizer can be applied in irrigation water. Fertilizer distribution is only as good as the water distribution.

Cooperative Extension Work in Agriculture and Home Economics, The Texas A. & M. College System and U
States Department of Agriculture cooperating. Distributed in furtherance of the Acts of Congress of Ma
1914, as amended, and June 30, 1914.
25M—7-60